

Supplementary Information

Increasing impacts of land-use on biodiversity and carbon-sequestration driven by population and economic growth

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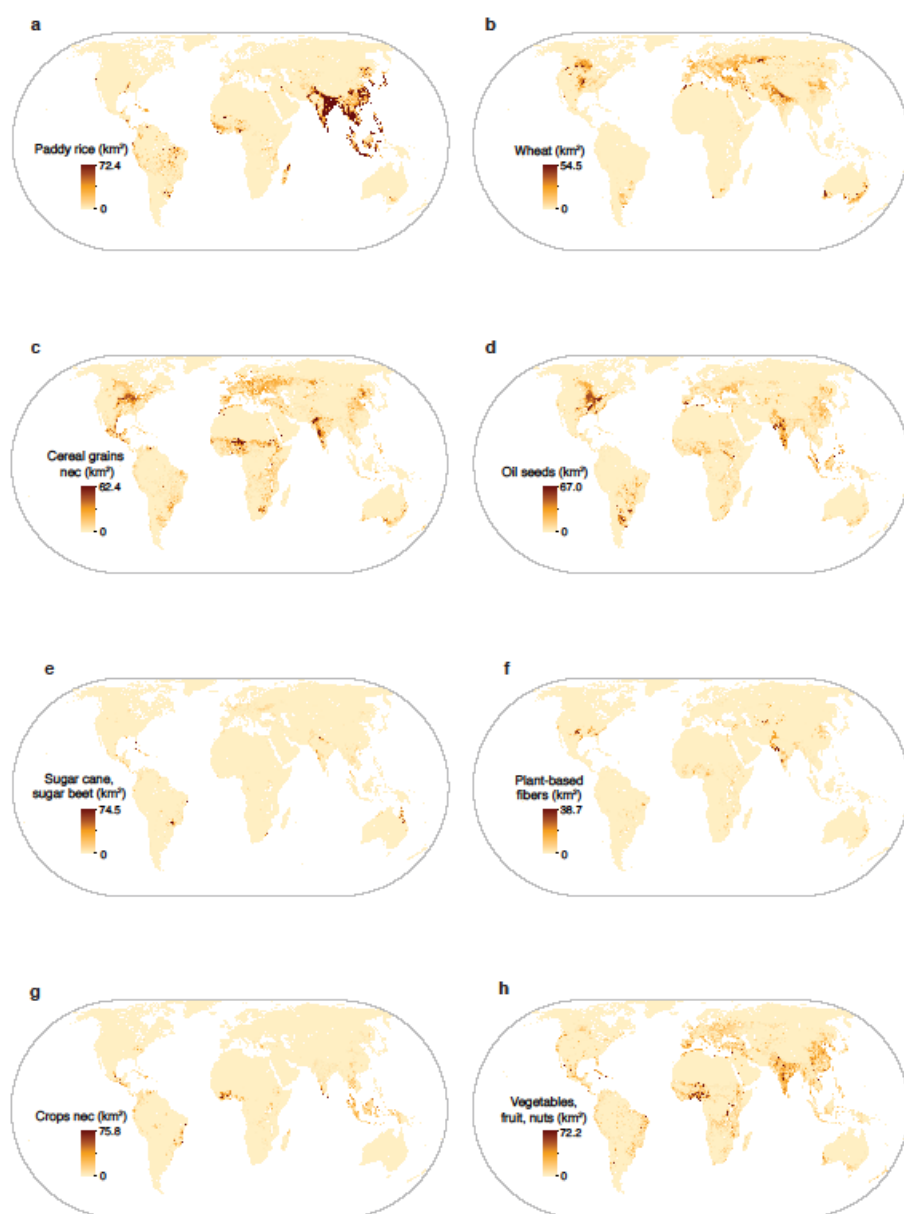
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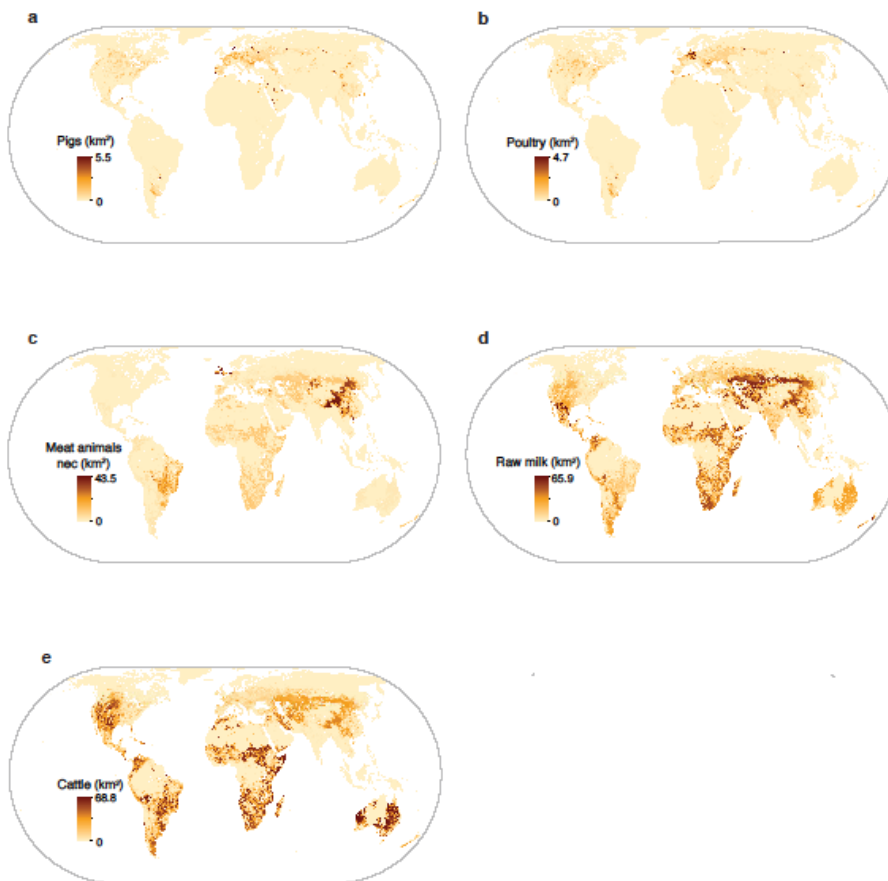
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Supplementary figures

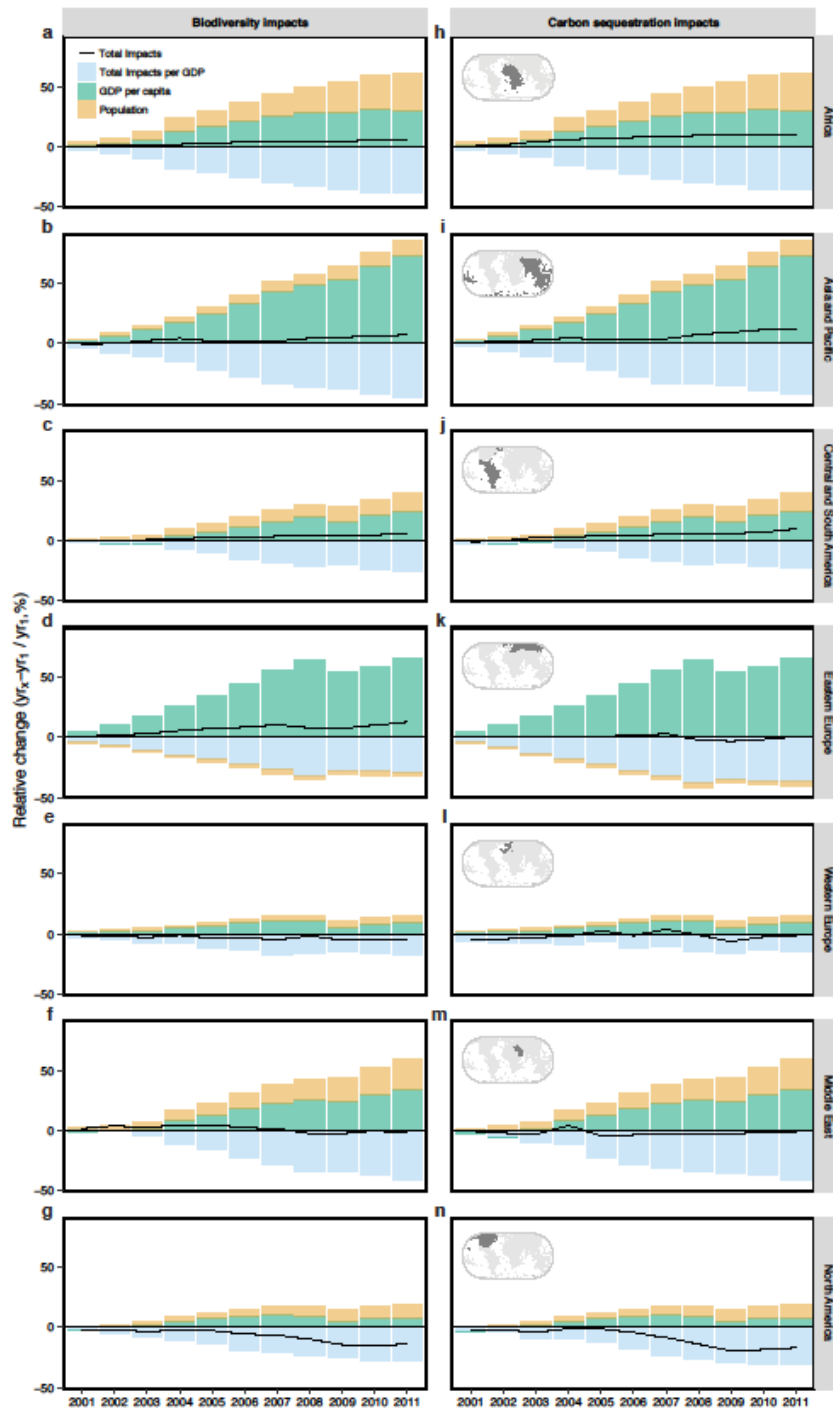
Supplementary Figure 1: Land-use maps (a-h), in km², for the non-fodder crops layers at 5 arc min resolution Nec stands for not elsewhere classified. This figure was created using ArcGIS 10.2.1 software and the land-use spatially explicit dataset described in the Methods section



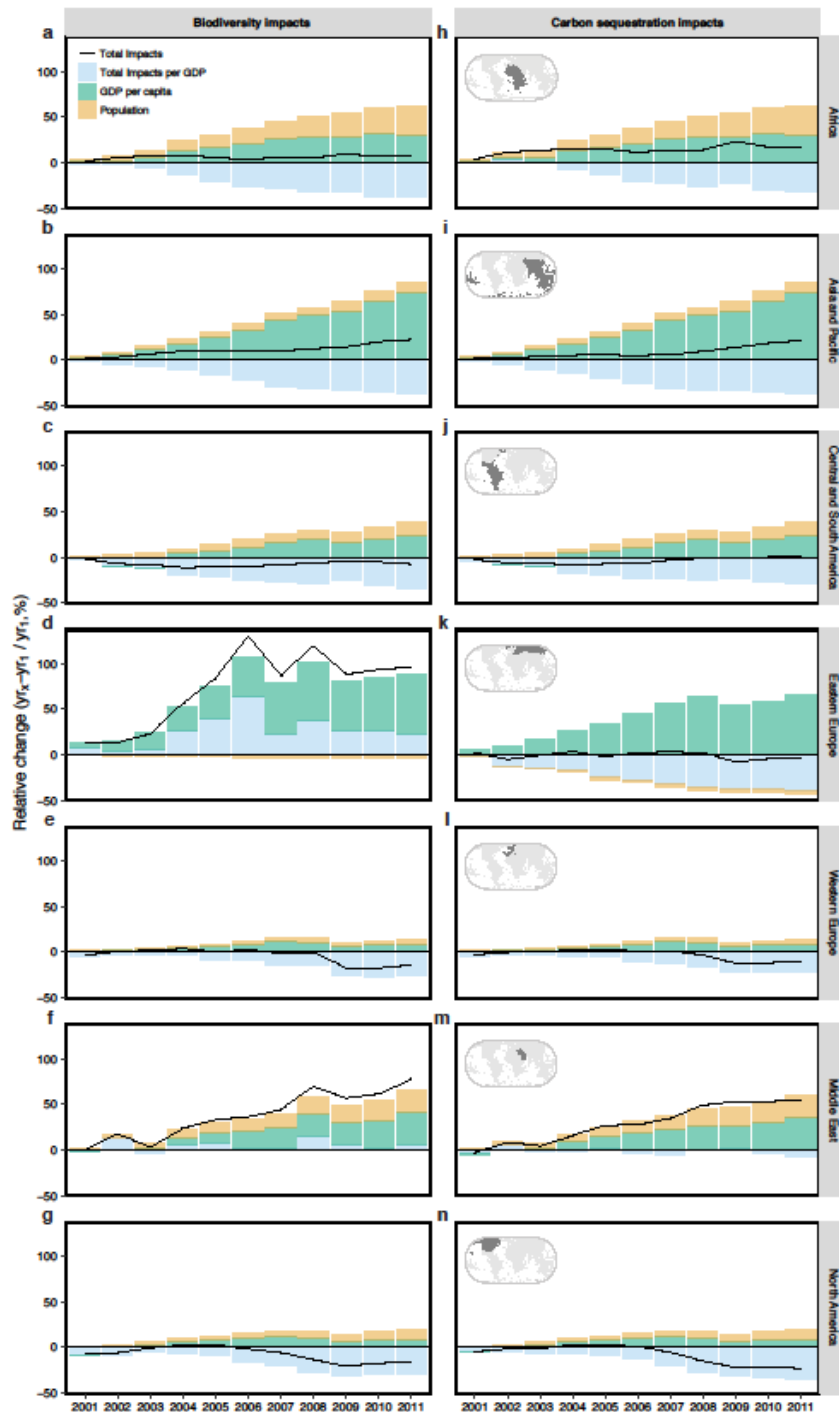
Supplementary Figure 2: Land-use maps (a-e), in km², for the fodder crops (raw milk, cattle meat, pig meat, poultry and other meat), and permanent pastures (raw milk, cattle meat, other meat) at 5 arc min resolution Nec stands for not elsewhere classified. This figure was created using ArcGIS 10.2.1 software and the land-use spatially explicit dataset described in the Methods section.



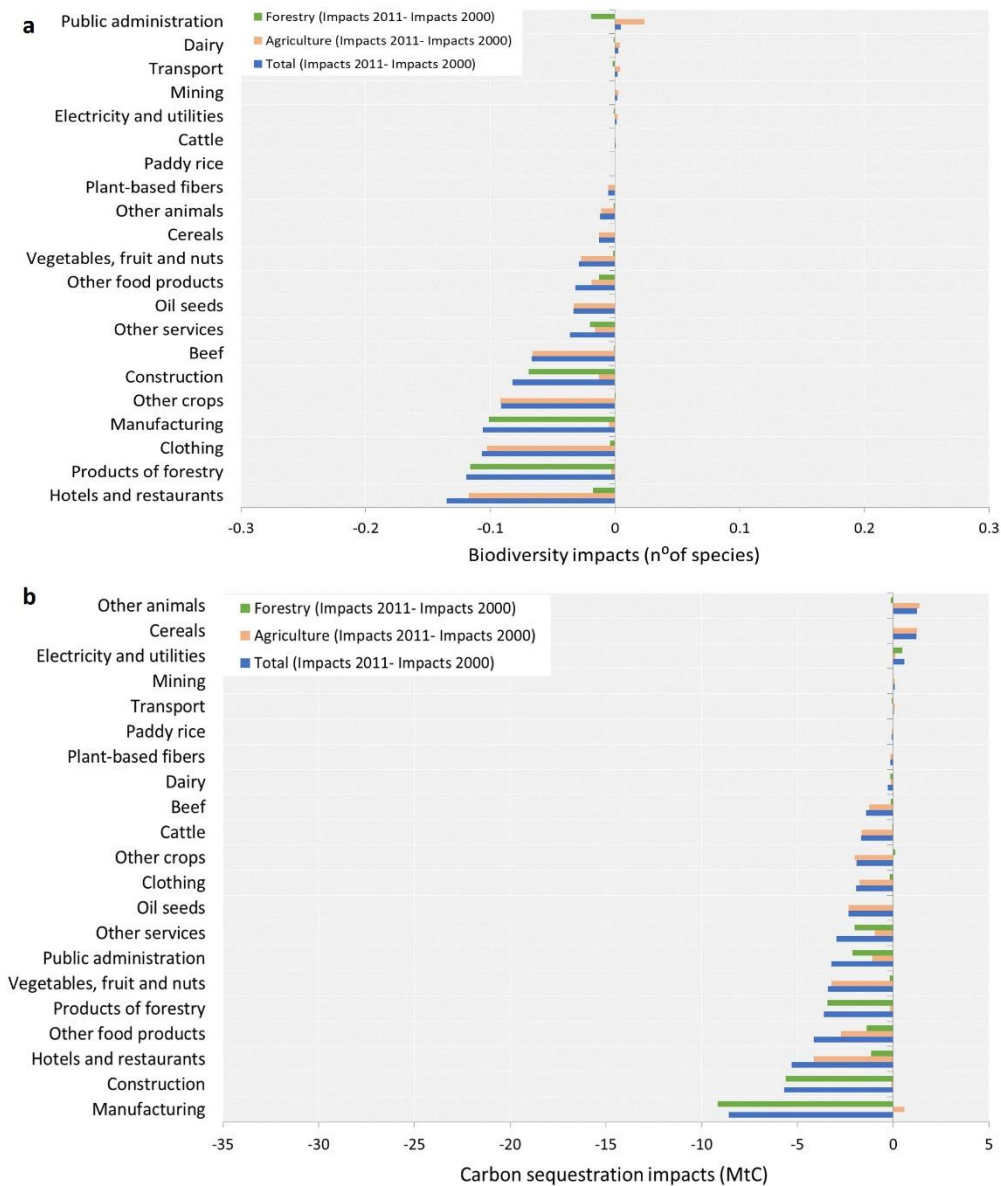
Supplementary Figure 3: Decomposition of impacts from agricultural and forestry production activities on biodiversity (a-g) and carbon sequestration (h-n) into their immediate drivers for 7 world regions. Inset map was created based on Natural Earth countries boundaries and the United Nations regional groups using ArcGIS software version 10.2.1.



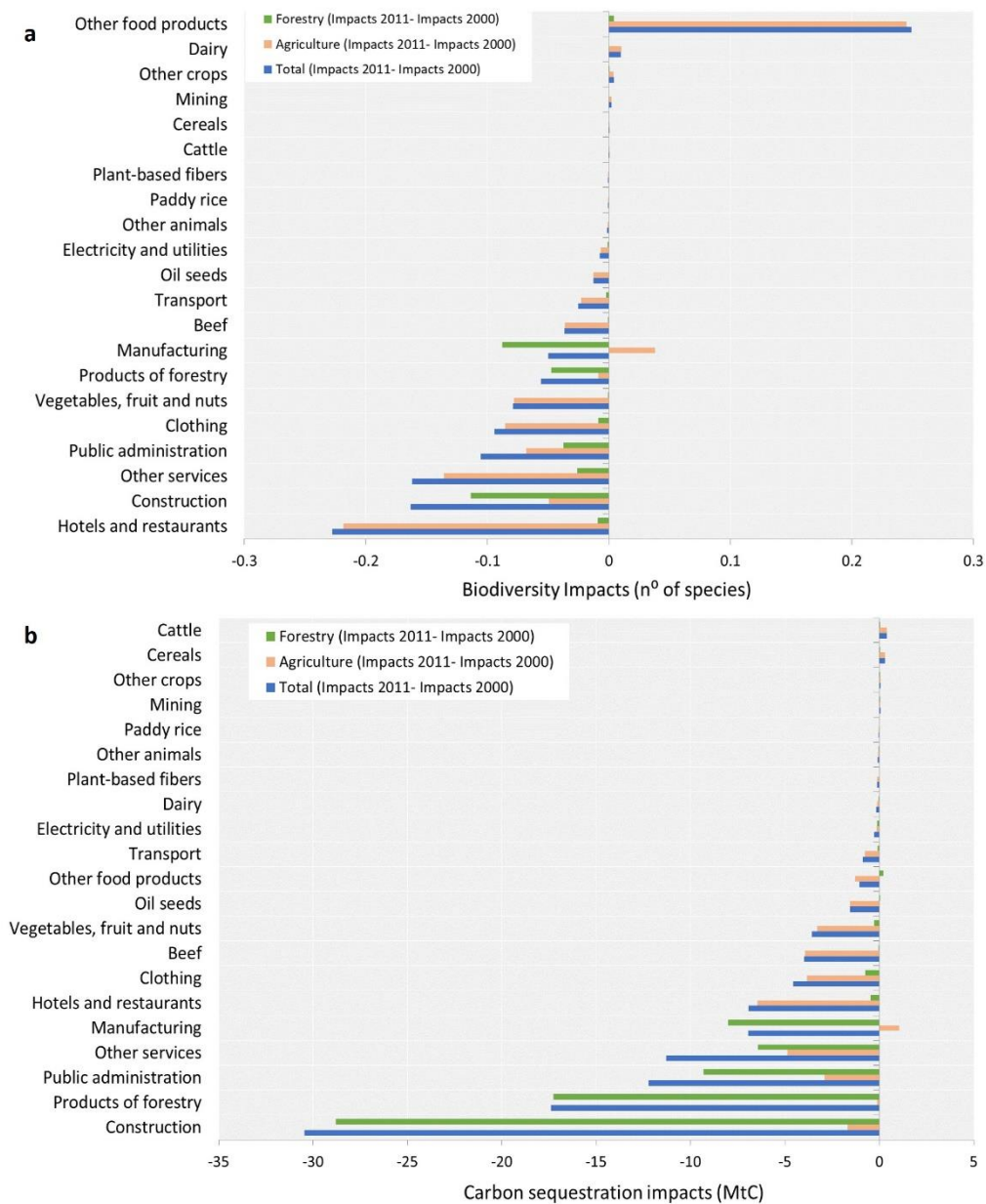
Supplementary Figure 4: Decomposition of impacts from consumption activities on biodiversity (a-g) and carbon sequestration (h-n) into their immediate drivers for 7 world regions. Inset map was created based on Natural Earth countries boundaries and the United Nations regional groups using ArcGIS software version 10.2.1.



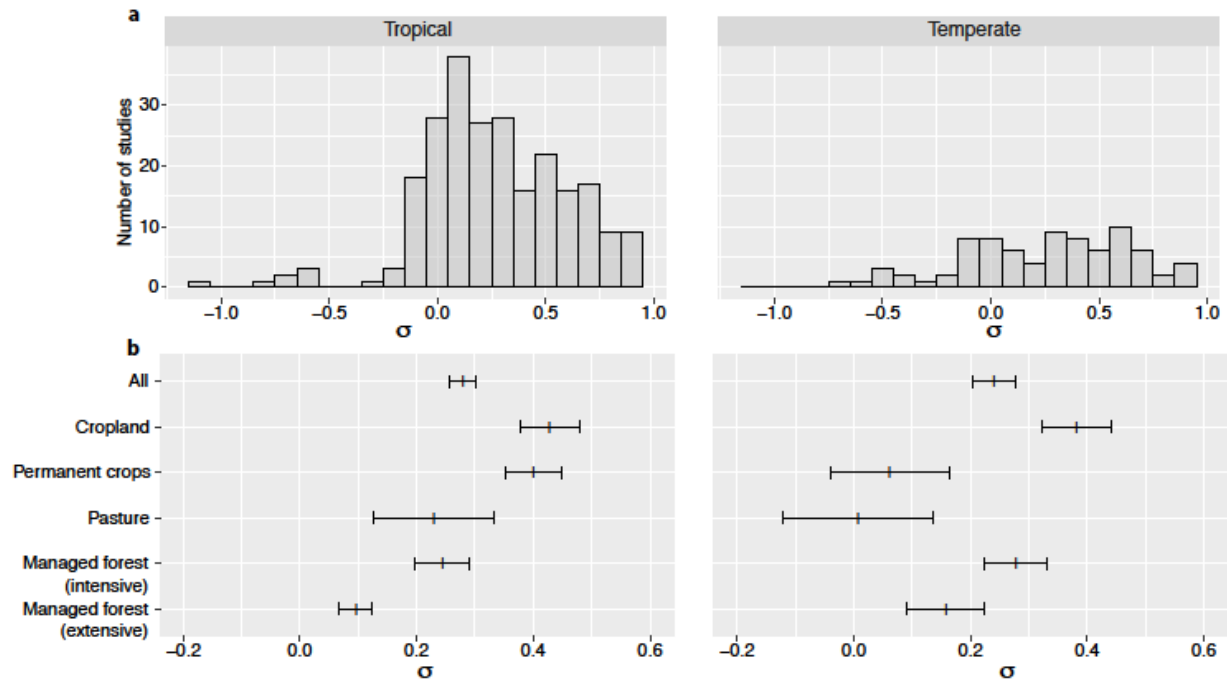
Supplementary Figure 5: Sectoral disaggregation of the change in impacts between 2011 and 2000 on a) biodiversity (a; number of bird species) and carbon sequestration (b; MtC per year) in Western Europe.



Supplementary Figure 6: Sectoral disaggregation of the change in impacts between 2011 and 2000 on a) biodiversity (a; number of bird species) and carbon sequestration (b, MtC per year) in North America.



Supplementary Figure 7: Local scale sensitivity (σ) of species to the full conversion of native habitat into the human-modified habitat (i.e. the proportion of species disappearing at the plot-scale in human-modified habitats) in tropical and temperate regions. **a, Distribution of σ found in the literature. **b**, range of σ values to the different land-use activities. Error bars in **b** indicate standard errors.**



Supplementary Tables

Supplementary Table 1: Number of endemic bird species in each bird's zoogeographic region of the World (ZWR) Number of endemic species present in each of the biogeographic regions (S_m).

ZWR	ZWR legend	Region	S_m
1	Mexican	Temperate	55
2	North American	Temperate	5
3	Panamanian - Amazonian	Tropical	199
4	South American	Temperate	103
5	Amazonian - South American	Tropical	220
	Arctico-Siberian - Eurasian - North		
6	America	Temperate	0
7	Guineo-Congolian	Tropical	12
8	African	Tropical	226
9	Eurasian - Saharo-Arabian	Temperate	21
10	Madagascan	Tropical	17
11	Eurasian - Artico-Siberian	Temperate	2
12	Oriental	Tropical	74
13	Eurasian - Tibetan - Artico-Siberian	Temperate	13
14	Indo-Malayan	Tropical	106
	Japanese - Chinese - Eurasian -		
15	Oriental	Temperate	6
16	Australian	Temperate	25
17	Papua-Melanesian - Indo-Malayan	Tropical	198
18	Novozelandic	Temperate	0
19	Papua-Melanesian	Tropical	13

Supplementary Table 2: Impending birds extinctions driven by production activities per year/country (conservative estimates) Unit: number of bird species loss. See Excel file.

Supplementary Table 3: Impending bird extinctions driven by production activities per year/product (conservative estimates). Nec stands for not elsewhere classified Unit: number of bird species loss. See Excel file.

Supplementary Table 4: Loss of carbon sequestration potential driven by production activities per year/country Unit: tons C (not sequestered)/yr. See Excel file.

Supplementary Table 5: Loss of carbon sequestration potential driven by production activities per year/product. Nec stands for not elsewhere classified Unit: tons C (not sequestered)/yr. See Excel file.

Supplementary Table 6: Impending bird extinctions driven by production activities per year/country (non-conservative estimates) Unit: number of bird species loss. See Excel file.

Supplementary Table 7: Impending bird extinctions driven by production activities per year/product (non-conservative estimates). Nec stands for not elsewhere classified. Unit: number of bird species loss. See Excel file.

Supplementary Table 8: Impending bird extinctions (conservative estimates) per km² of land use. Nec stands for not elsewhere classified. Unit: number of bird species lost per km². See Excel file.

Supplementary Table 9: Loss of carbon sequestration potential per km² of land use. Nec stands for not elsewhere classified. Unit: tons C (not sequestered)/km². See Excel file.

Supplementary Table 10: Total land use per year/country Unit: km². See Excel file.

Supplementary Table 11: Impending bird extinctions (species numbers) due to domestic consumption and international trade between world regions, in 2000 and 2011. The grey cells indicate the impacts associated with domestic consumption. In the rows the impacts associated with the exports to other world regions are represented and in the columns the impacts associated with the imports from each region. Summing over the rows provides the total production impacts of a region, summing over the columns the total consumption impacts of a region.

	Western Europe	Eastern Europe	Middle East	North America	Asia and Pacific	Africa	Central and South America
2000							
Western Europe	0.090	0.001	0.002	0.004	0.003	0.001	0.001
Eastern Europe	0.018	0.091	0.006	0.003	0.014	0.001	0.001
Middle East	0.010	0.001	0.093	0.004	0.005	0.002	0.001
North America	0.024	0.002	0.010	0.335	0.055	0.004	0.027
Asia and Pacific	1.460	0.299	0.439	1.642	19.022	0.145	0.238
Africa	2.315	0.191	0.417	0.563	0.711	14.137	0.150
Central and South America	2.083	0.215	0.428	2.179	1.127	0.179	20.733
2011							
Western Europe	0.084	0.003	0.002	0.003	0.004	0.002	0.001
Eastern Europe	0.019	0.082	0.019	0.005	0.019	0.005	0.001
Middle East	0.008	0.003	0.089	0.003	0.007	0.004	0.001
North America	0.016	0.003	0.012	0.253	0.080	0.005	0.025
Asia and Pacific	1.119	0.319	0.570	0.999	21.332	0.296	0.272
Africa	1.902	0.323	0.699	0.630	1.303	14.331	0.234
Central and South America	1.996	0.746	1.089	2.080	2.836	0.738	19.065

Supplementary Table 12: Carbon sequestration lost (MtC) due to international trade

between world regions, in 2000 and 2011. The grey cells indicate the impacts associated with domestic consumption. In the rows the impacts associated with the exports to other world regions and in the columns the impacts associated with the imports from each region. Summing over the rows provides the total production impacts of a region, summing over the columns the total consumption impacts of a region.

	Western Europe	Eastern Europe	Middle East	North America	Asia and Pacific	Africa	Central and South America
2000							
Western Europe	185.549	4.374	6.280	8.013	9.816	2.790	2.205
Eastern Europe	43.526	293.921	10.516	7.994	33.127	1.528	1.644
Middle East	1.287	0.186	18.139	0.412	0.538	0.180	0.108
North America	17.751	1.269	4.924	302.099	38.704	1.354	16.062
Asia and Pacific	56.056	11.511	16.702	64.446	998.190	7.134	9.769
Africa	59.098	4.234	9.140	13.034	20.568	247.921	3.202
Central and South America	41.811	3.892	6.585	37.594	21.003	2.556	534.759
2011							
Western Europe	179.731	7.245	5.325	5.443	8.847	4.982	1.688
Eastern Europe	45.229	266.102	26.211	8.630	38.507	7.232	2.740
Middle East	1.022	0.409	17.800	0.295	0.676	0.335	0.088
North America	10.914	2.341	6.393	226.177	55.311	2.281	14.375
Asia and Pacific	47.700	13.915	23.023	43.643	1158.846	12.286	11.569
Africa	43.620	6.802	13.283	13.883	41.665	266.447	4.894
Central and South America	33.224	12.901	19.607	34.793	56.344	10.748	543.413

Supplementary Table 13: Correspondence between the habitat types used for the computation of the h parameter (affinity), of the countryside species area relationship, and the land use classification used in this study. Nec stands for not elsewhere classified.

Habitats	EXIOBASE's Land use sectors
Cropland	Paddy rice
	Wheat
	Cereal grains nec
	Oil seeds
	Sugar cane, sugar beet
	Plant-based fibers
	Crops nec
	Pigs
	Poultry
Permanent crops	Vegetables, fruit, nuts
Pastures	Meat animals nec
	Raw milk
	Cattle
Managed Forest	Forest used

Supplementary Table 14: Average rotation length (years) per world region Averaged rotation length when considering the rotation lengths reported for both forest plantations and semi-natural planted forest. See Excel file.

Supplementary Table 15: Correction factors applied to forest areas for quantification of biodiversity impacts. The correction factor may vary between 0 and 1, 0 means that the area is removed and 1 means that the area stays the same. See Excel file.

Supplementary Table 16: Affinity values (*h*) computed for the countryside species area relationship model used in the quantification of biodiversity impacts. Affinity values can be interpreted as the proportion of area of modified habitat that can be effectively used by a particular species group.

	Tropical	Temperate
Cropland	0,062	0,091
Permanent crops	0,077	0,731
Pastures	0,273	0,970
Managed Forest (intensive use)	0,247	0.196
Managed Forest (intensive and extensive use)	0,409	0,239

Supplementary Table 17: Local sensitivities (σ - sigma) for each land use sector Complete list of birds local sensitivities (σ - sigma) values. A total of 319 pairwise comparisons across two broad ecological regions (tropical and temperate), and four different human-modified habitats (annual crops, managed forest, permanent crops and pastures) were retrieved from the literature. Studies ('Source 3') were considered if they provided data on species richness on both a native habitat and at least one human-modified habitat. For several studies, more than one possible pairwise comparisons was reported. See Excel file.

Supplementary Table 18: Regional disaggregation of EXIOBASE The world region aggregation followed United Nations regional groups*. * UN. United Nations regional groups of member states. (United Nations, 2014). See Excel file.

Supplementary Table 19: Product disaggregation of EXIOBASE See Excel file.